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# WEATHER AND CIRCULATION OF JULY 1972

## Record Cold in the Northern Great Plains and Northern Rocky Mountains

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## 1. MEAN CIRCULATION

Retrogression of the long waves was a primary characteristic of the evolving mean 700-mb circulation from June to July 1972 (figs. 1, 2). This westward motion brought about some distinct changes in the mean flow pattern from that of June (Wagner 1972).

The retrogression was related to a general slackening in the mean speed of the midlatitude zonal westerlies. The zonal index for the Western Hemisphere was slightly below normal in July in contrast to the stronger than normal flow that had persisted during much of 1972 thus far. Contributing to the lower index was a general rise of mean 700-mb height departures from June to July north of 50°N with height falls predominating to the south (fig. 3). This was particularly evident over both oceans, where the strong westerly flow of June weakened considerably in July. The midlatitude westerlies did strengthen somewhat over eastern North America, however (figs. 3, 4).

Mean 700-mb anomalies over the Pacific Ocean in July were basically reversed from those of June. The Bering Sea Low weakened and moved southwestward, establishing a mean trough over the western Pacific Ocean. Deepening cyclones associated with this retrograded trough position helped to build a blocking High over Alaska. South of the

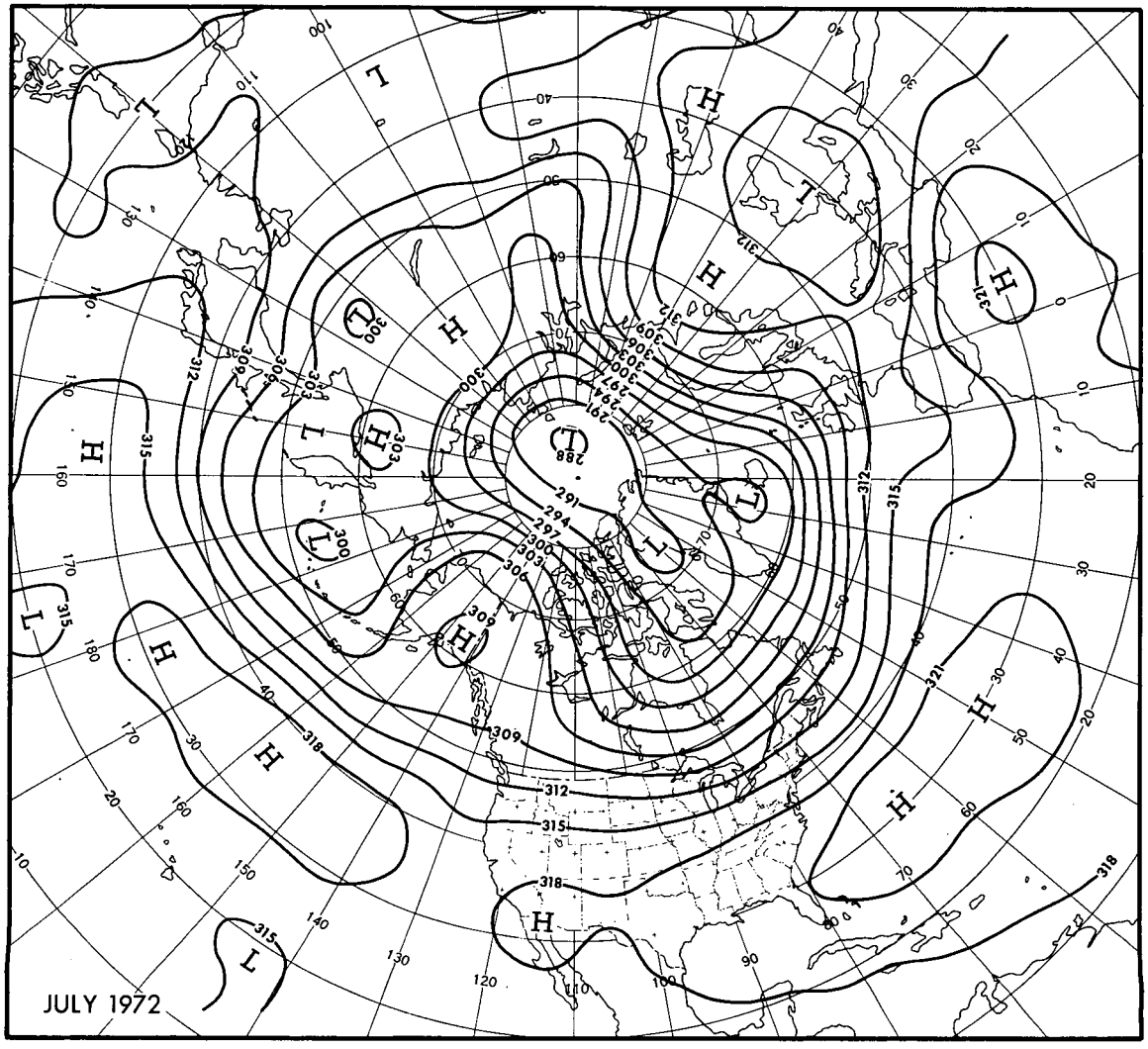



FIGURE 1.—Mean 700-mb contours in dekameters (dam) for July 1972.

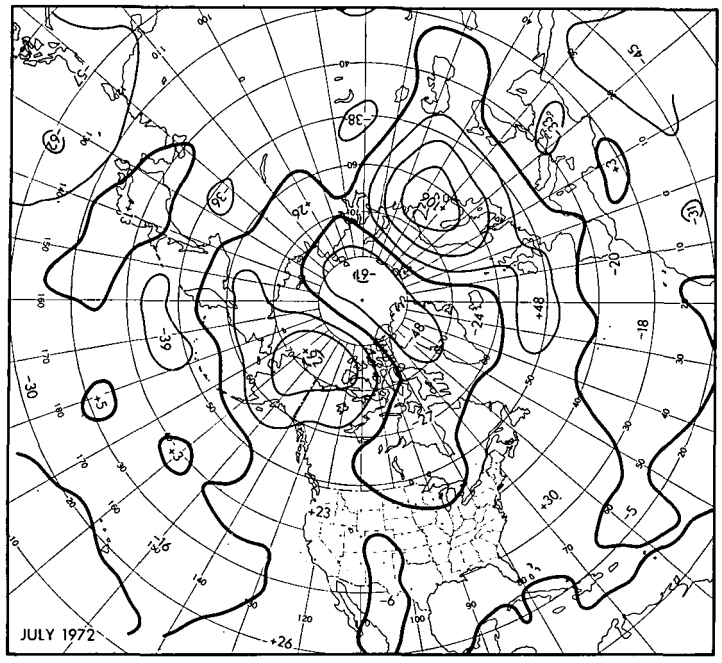



FIGURE 2.—Departure from normal of mean 700-mb height in meters (m) for July 1972.

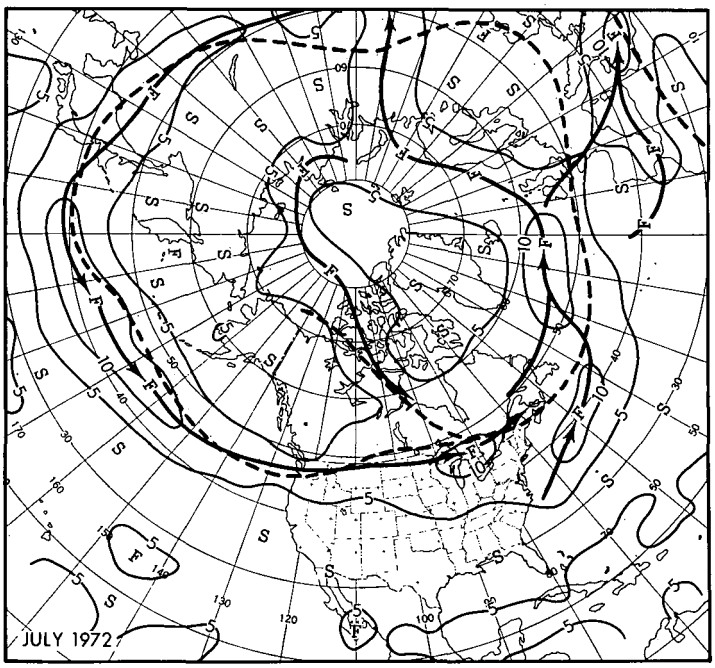



FIGURE 4.—Mean 700-mb geostrophic wind speed (m/s) for July 1972. Solid arrows show the observed axes of maximum wind speed, and dashed lines show the normal.

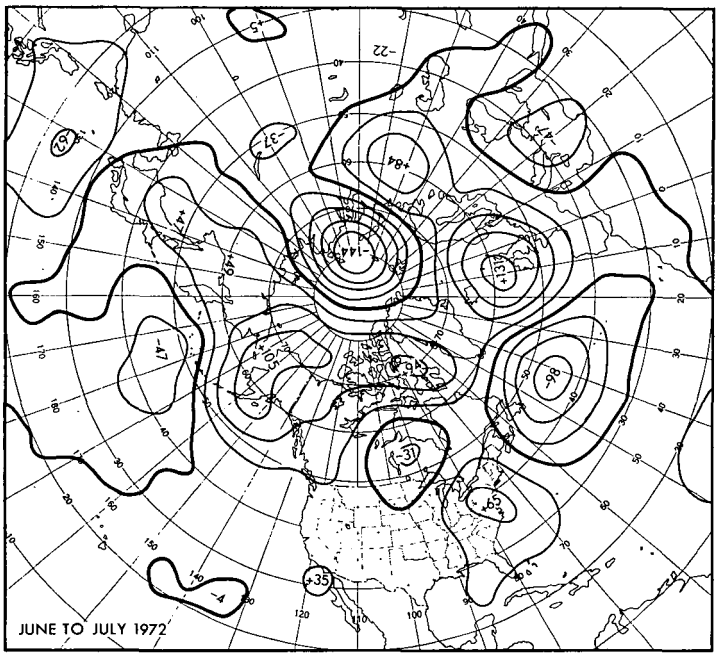



FIGURE 3.—Mean 700-mb height anomaly change (m) from June to July 1972.

block, ridges were observed over the eastern Pacific and western United States with a trough along the west coast.

Over North America, the Low in Baffin Bay was nearly stationary, but the attendant trough stretched southward to the Great Lakes instead of along the Atlantic Coast. A remnant of the trough was located east of New England with a ridge over the Northeast.

Positive height departures bridged across Great Britain from the eastern Atlantic ridge to the European block. Although the northern portion of the Atlantic ridge progressed in July, the High itself moved southwestward and became part of an elongated subtropical ridge that extended into the southern United States.

Blocking remained strong along the western border of Russia in July. The center of the positive anomaly did move southwestward, however, as a Low dominated the circulation near the North Pole. A Low remained stationary near the Black Sea south of the block. Downstream, a weakening trough was observed over western Asia with a blocking pattern to the east.

Three typhoons formed over tropical areas of the Pacific Ocean during July. Caught in the mean southeasterly flow, they moved toward Japan. Two of them struck southern Japan causing floods with some loss of life. Harder hit was the island of Luzon in the Philippine Islands. Almost daily rains there caused massive flooding that affected about six million people.

## 2. TEMPERATURE

The abnormally strong northerly flow east of the mean Alaskan ridge pushed several outbreaks of cold polar air southward into the country during July. Consequently, mean surface temperatures for the month were lower than normal over much of the Nation (fig. 5). Repeated intrusions of cold polar air into the Northern Rocky Mountains and Great Plains made this month one of the coldest Julys on record at stations within the region (table 1).

Temperatures were above normal in the Southwest, under the mean 700-mb ridge, and along the Pacific coast, and in part of the Northeast. Record-breaking warmth was reported in Alaska (table 1) in response to the strong Alaskan block.

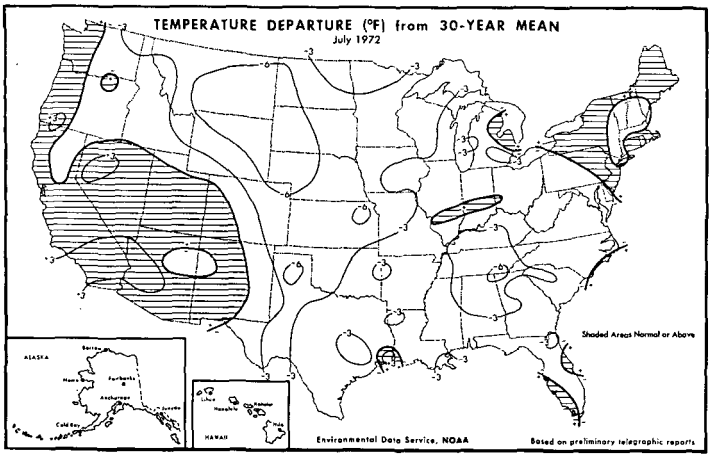



FIGURE 5.—Departure from normal of average surface temperature (°F) for July 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

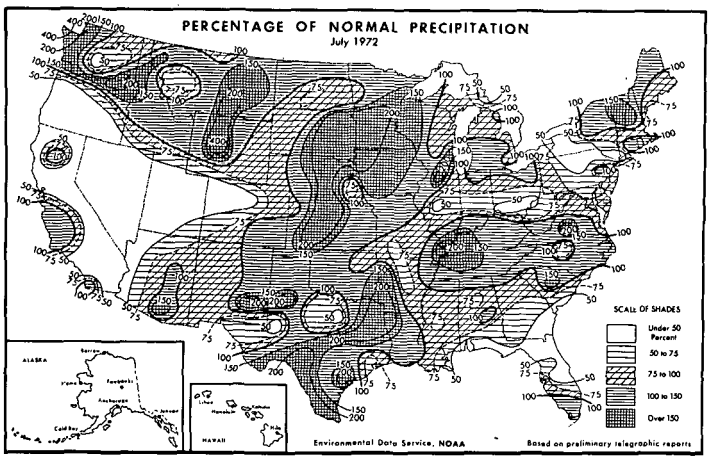



FIGURE 6.—Percentage of normal precipitation for July 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

TABLE 1.—*Notable mean monthly station temperatures for July 1972*

| Station | Temperature (°F) | Anomaly (°F) | Remarks |
|---|---|---|---|
| Billings, Mont. | 66.6 | −8.1 | 2d coldest July |
| Glasgow, Mont. | 64.7 | −6.0 | Coldest July since 1915 |
| Helena, Mont. | 61.7 | −6.7 | Do. |
| Williston, N. Dak. | 64.0 | −7.3 | Coldest July back to 1879 |
| Rapid City, S. Dak. | 65.6 | −8.2 | 2d coldest July and coldest since 1915 |
| Port Arthur, Tex. | 79.4 | −2.5 | Coldest July back to 1917 |
| Casper, Wyo. | 65.9 | −5.8 | Coldest July |
| Sheridan, Wyo. | 64.1 | −7.2 | Coldest July since 1915 |
| Kotzebue, Alaska | 59.0 | +6.3 | Warmest month |
| Nome, Alaska | 56.1 | +6.6 | Do. |

TABLE 2.—*Record and near-record precipitation during July 1972*

| Station | Amount (in.) | Remarks |
|---|---|---|
| Cairo, Ill. | 9.20 | Wettest since 1875 |
| Rockford, Ill. | 8.39 | 2d wettest July back to 1906 |
| Sioux City, Iowa | 10.33 | Wettest July and 2d wettest month |
| Shreveport, La. | 9.46 | Wettest July since 1933 |
| Aberdeen, S. Dak. | 7.71 | Wettest July back to 1896 |
| Huron, S. Dak. | 4.93 | Wettest July since 1920 |
| Grand Junction, Colo. | 0.03 | Driest July since 1898 |

## 3. PRECIPITATION

Precipitation during July 1972 was more than 50 percent greater than normal over much of the region from Texas to Lake Superior (fig. 6). In fact, this July was the second wettest month ever recorded at Sioux City, Iowa (table 2). Much of the precipitation northward from Kansas fell during a 1-week period as moist Gulf of Mexico air was advected over the area. Heavy precipitation also fell during July in the Pacific Northwest.

The problem of drought returned to the Southwest. Rainfall totals over much of the region were less than half of the normal, as a mean ridge prevailed. Monthly precipitation was near or below normal in much of the East in contrast to the excessively wet conditions of June 1972. July precipitation was also lighter than usual in most of Alaska in connection with blocking aloft.

## 4. WEEKLY VARIABILITY

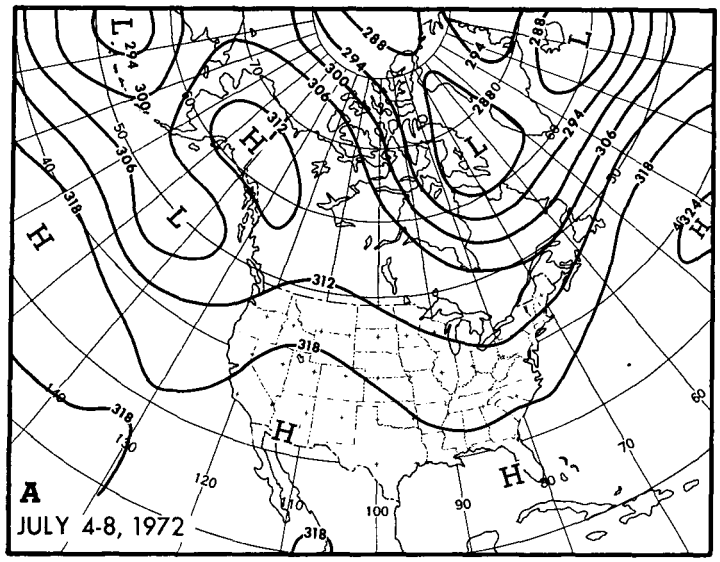
Retrogression of the long waves during July 1972 is well depicted in the series of 5-day mean 700-mb maps (figs. 7A, 8A, 9A, 10A) used to represent the weekly circulation. During the first week of July 1972, the mean circulation over North America was characterized by a trough in the East and a ridge in the West (fig. 7A). A trough extended southward from a Low in the Gulf of Alaska, while a ridge was located in the Atlantic Ocean south of Greenland.

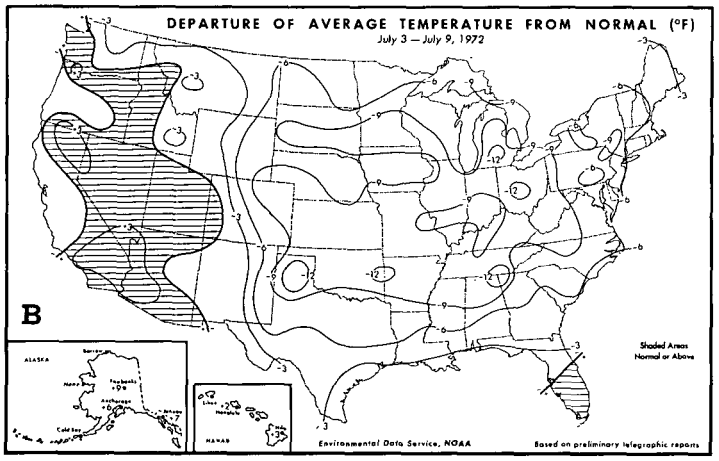
By the next week, the Gulf of Alaska Low had moved westward to the Aleutians, where it merged with another Low (fig. 8A). The resultant circulation over the Pacific allowed a general retrogression of downstream components to take place. The establishment of the trough over mid-North America was aided by the influx of cyclonic vorticity to the east of the strong Alaskan ridge.

Strong retrogression continued into the July 18–22 period as the circulation in the Pacific amplified (fig. 9A). The southern portion of the midcontinent trough was now near the west coast, while the former Atlantic ridge moved inland over the eastern United States.

By the last week of July, the mean circulation (fig. 10A) had reverted to nearly the pattern of the first week. A new Low developed in the Gulf of Alaska, and continued retrogression of a portion of the east coast ridge helped to reestablish a ridge in the West. The Hudson Bay Low moved eastward to augment the trough off the east coast.

Weekly mean temperatures over the United States during July 1972 (figs. 7B, 8B, 9B, 10B) varied as did the elements of the mean circulation. The month began cold over much of the country as the strong Alaskan ridge transported polar air southward into the Nation. Temperature departures were increasingly positive during the next week as a strengthened band of westerlies along the



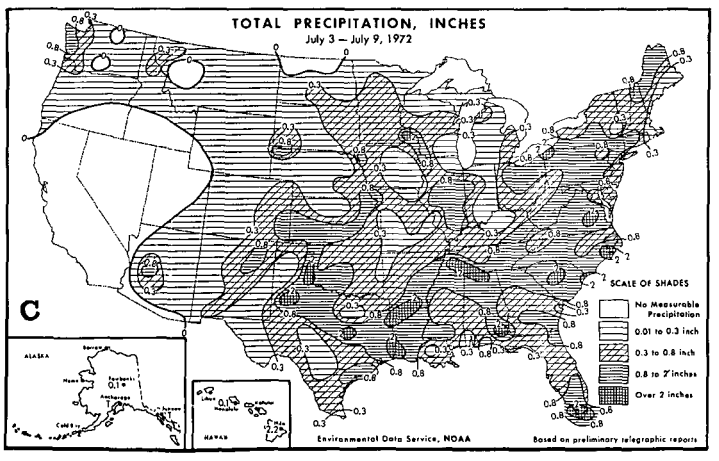
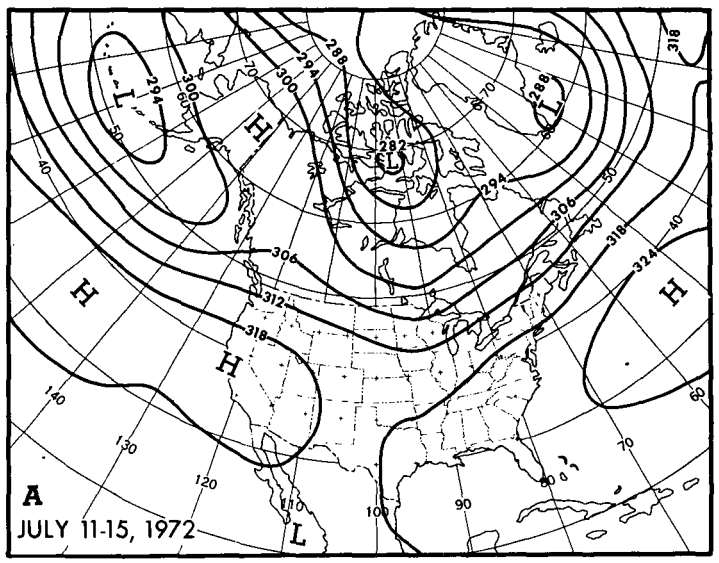
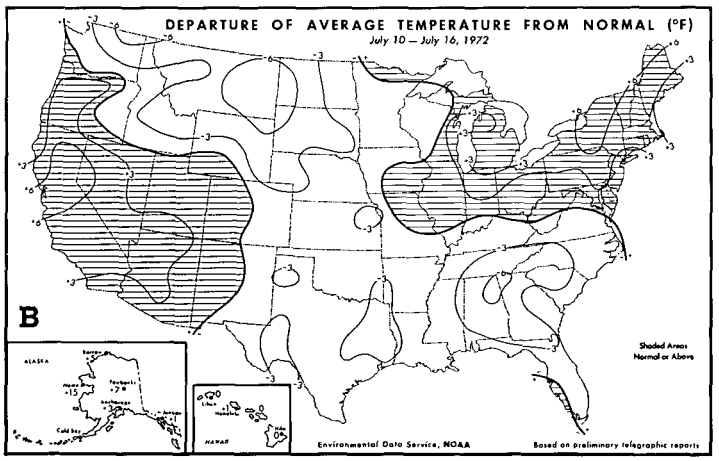




FIGURE 7.—(A) mean 700-mb contours (dam) for July 4–8, 1972; (B) departure from normal of average surface temperature (°F) and (C) total precipitation (in.) for week of July 3–9, 1972 (from Environmental Data Service and Statistical Reporting Service 1972).



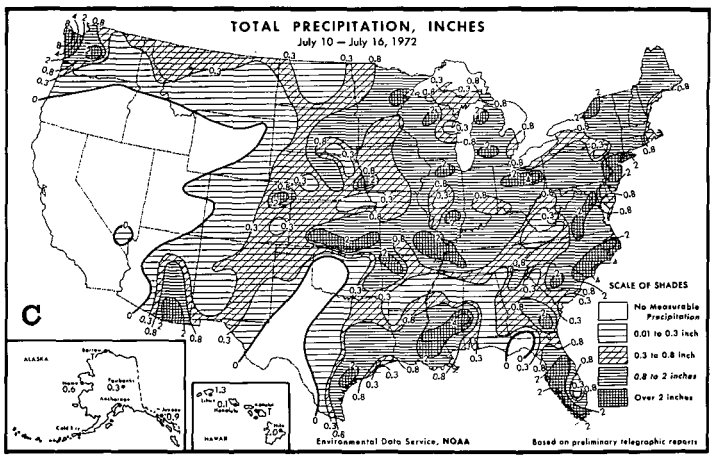
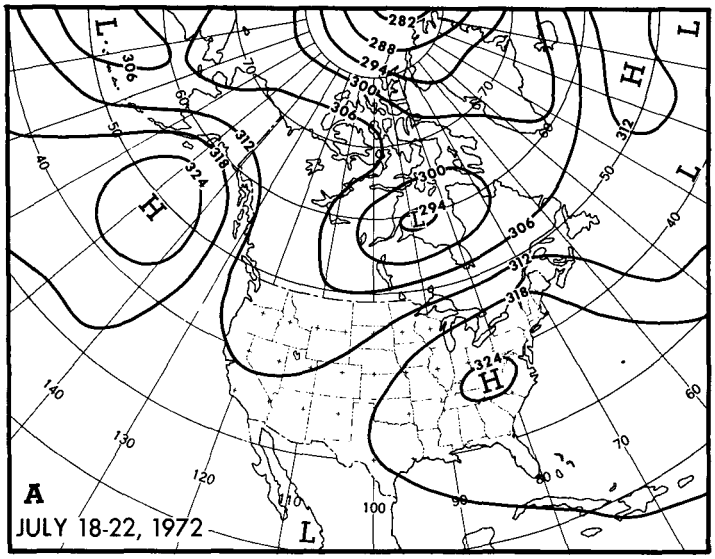



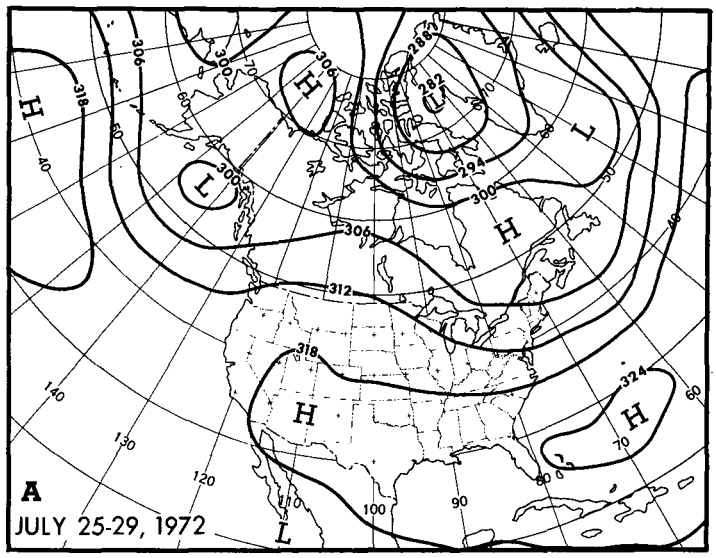

FIGURE 8.—Same as figure 7, (A) for July 11–15, 1972; (B) and (C) for week of July 10–16, 1972.

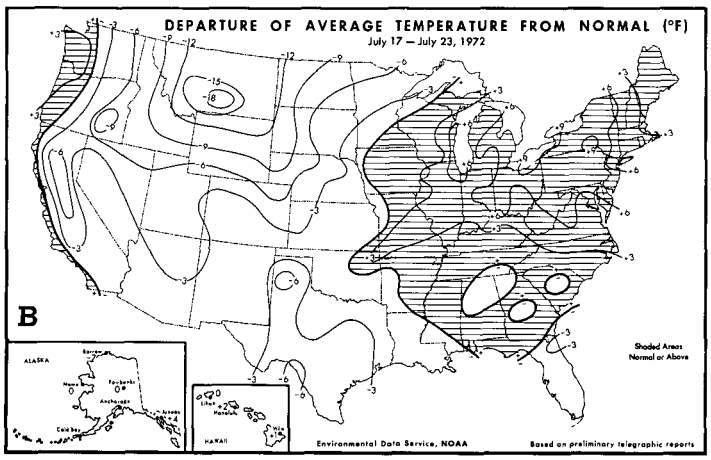
northern border contained the cold air in Canada. In addition, a ridge still maintained itself over the West, and retrogression of the Atlantic ridge warmed the East.

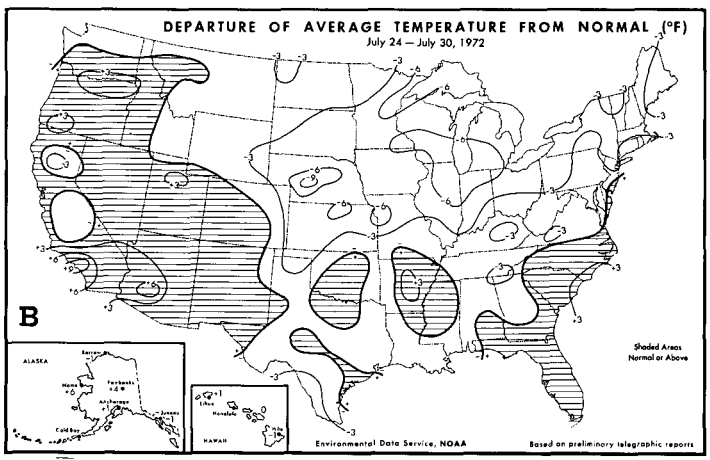
The East continued to warm during the week of July 17–23 as the Atlantic ridge moved over the region. Upstream, the retrograding trough dropped cold air into the West, where some snow fell at higher elevations. By the last week of July, the temperature anomaly pattern had returned to basically that of the first week, although temperatures were not as low.

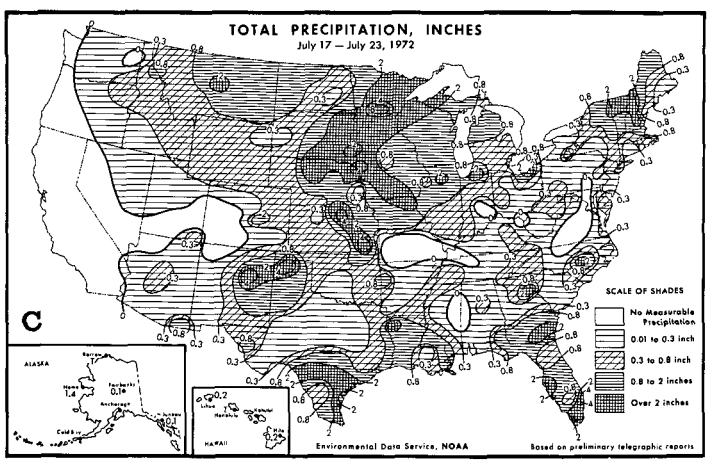
The cold air that covered much of the Nation during the first week (fig. 7B) produced many records. Cold air entered Montana on the 3d and moved slowly to the mid-Atlantic coast by the 9th. During this time, many stations



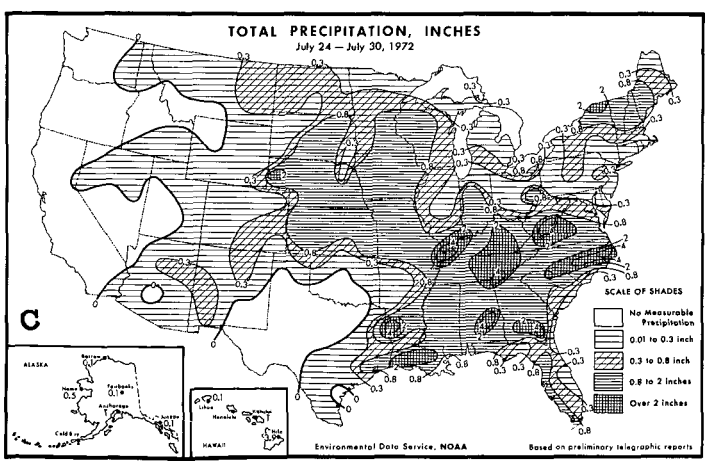




FIGURE 9.—Same as figure 7, (A) for July 18–22, 1972; (B) and (C) for week of July 17–23, 1972.

FIGURE 10.—Same as figure 7, (A) for July 25–29, 1972; (B) and (C) for week of July 24–30, 1972.

eastward from the Rocky Mountains recorded the lowest July temperatures in their histories.

Record high temperatures were observed in California during the week of July 10–16. All-time record maxima occurred on the 14th at Stockton (114°F) and Blue Canyon (95°F) and on the 15th at Red Bluff (119°F). The warmest period of the summer thus far began in the Northeast during this same period. By the beginning of the following week, hot, humid air engulfed most of the East. Electrical shortages became prevalent as air conditioning equipment came into heavy use. Air pollution added to the problem as light winds failed to disperse stack and auto emissions. A cold front brought relief to most of the region by the 26th, however.

Most of the country east of the Rocky Mountains received some precipitation each week during July (figs. 7C,

8C, 9C, 10C). The rainfall totals were highly variable, however, typical of summertime shower and thunderstorm activity.

More than 8 in. of rain fell along the coast of Washington during the week of July 10–16 (fig. 8C) as onshore 700-mb winds were observed over the region. A weak tropical Low came ashore in South Carolina on the 12th causing some heavy rains in the East, northward to New England.

The most widespread and heaviest precipitation occurred during the week of July 17–23 (fig. 9C). More than 2 in. of rain fell over most of the area from Kansas to the Canadian border. A few stations in Minnesota received more than 8 in. of precipitation from torrential rains near the end of the week. Fort Ripley reported 11.18 in. in a 24-hr period ending on the 22d. This amount established a new 24-hr precipitation record for the entire State. Considerable flooding occurred in the area, with much damage to property and crops. This heavy precipitation was related to the advection of moisture from the Gulf of Mexico into the confluent zone over the region at 700 mb. The rains were triggered by a cold front that moved slowly across the area.

The heavier rainfall totals from southeastern Missouri to the Atlantic coast during the last week (fig. 10C) were associated with an east–west front that lingered in the region.

## REFERENCES


Environmental Data Service, NOAA, U.S. Department of Commerce, and Statistical Reporting Service, U.S. Department of Agriculture, *Weekly Weather and Crop Bulletin*, Vol. 59, Nos. 28–32, July 10, 17, 24. 31 and Aug. 7, **1972**.

Wagner, A. James, "Weather and Circulation of June 1972—A Month with Two Major Flood Disasters, "*Monthly Weather Review*, Vol. 100, No. 9, Sept. **1972**, pp. 692–699.

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